

Application No. 10/085,249  
Amendment Dated June 10, 2004  
Reply to Office Action of March 24, 2004

### **REMARKS**

This Response is in response to the Office Action mailed March 24, 2004 in respect to this application. This Response is being filed within the 3-month shortened statutory period set for response in the Office Action. Claims 3, 4 and 5 are amended. Claims 1-15 are pending in this application subsequent to the present Amendment.

#### **ALLOWBLE SUBJECT MATTER:**

It is first noted and appreciated that the Examiner found allowable subject matter in claims 3-7. Claims 3, 4 and 5 are currently amended to be in independent form and to include all of the limitations of their base claim, claim 1. An error in each of these claims is corrected in that "third ratio" should have been "first ratio." Additionally, the limitation "and the first ratio of  $C_2F_6$  to  $CF_4$  is selected based on the third ratio of  $C_2F_6$  to  $CF_4$ " has been removed from each of these claims. It is not believed that these changes would affect the Examiner's position with respect to patentability. It is therefore respectfully requested that the Examiner pass claims 3-7, as amended, to allowance.

#### **REJECTION UNDER 35 U.S.C. § 102(e):**

The Examiner rejected claims 1-2, 8 and 9 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Publication No. US 2002/0134429 A1 (Kubota et al.) which, the Examiner states, shows all of the claimed limitations. Specifically, the Examiner states that Kubota et al. disclose the use of a mixture of  $CF_4$  and  $C_2F_6$  and  $O_2$  as an influent gas and recirculating 80% of the used gas back into the chamber by adding in the influent stream at 22 to create a third gas mixture. The Examiner goes on to state that the amount of  $CF_4$  and

volume of the effluent would inherently equal the amount of the influent since Kubota et al. use  $\text{CF}_4$  and  $\text{C}_2\text{F}_6$ .

Kubota et al. do not anticipate independent claims 1 or 2 or claims 8 and 9 (which depend from claim 1) for the following reasons. The invention of Kubota et al. is related to point-of-use recirculation of a process gas. Recirculating the process gas has the effect of increasing its utilization, and thus reducing the amount of gas used by the process. Recirculation is applicable to many processes (*e.g.*, etch processes and deposition processes), including CVD chamber cleaning. Kubota et al. disclose methods that overcome the problems of gas transport (*e.g.*, pressure, pipe sizing, etc.). Kubota et al. find it necessary to introduce virgin process gas (*e.g.*,  $\text{C}_2\text{F}_6$ ) simply as make-up flow. The recirculation rate cannot be 100% because this adversely impacts the process. Because not all (less than 80%) of the influent gas is recirculated, gas additions are necessary to maintain the gas flow rate.

The claims of the present invention are specifically directed toward fluorocarbon plasmas used for CVD chamber cleaning. At paragraph 0081, Kubota et al. do describe mixed gases. However, this is an inclusive description of current chamber clean processes (*e.g.*, the  $\text{C}_2\text{F}_6/\text{NF}_3/\text{O}_2$  process is well known). Kubota et al. do not teach that the plasma process generates other fluorine containing gases and this has implications for the gas composition. Specifically, the present specification identifies desirable compositions because  $\text{CF}_4$  is generated from  $\text{C}_2\text{F}_6$  during the chamber clean. Additions of virgin material are necessary to retain the original composition rather than simply make up the gas flow rate.

In his rejection, the Examiner states that "the amount of  $\text{CF}_4$  in the effluent would inherently equal the amount of the influent." This is not true and is the problem solved by the present invention. Because  $\text{CF}_4$  is generated by the plasma (from  $\text{C}_2\text{F}_6$ ), more  $\text{CF}_4$  may be

generated than consumed. If Kubota et al. attempt to maintain the same composition through  $C_2F_6$  additions, the amount of gas recirculated would need to be reduced.

Further, Kubota et al. is only concerned about feed gases. Kubota et al. do not teach about the impact of gas byproducts generated during the plasma process. For example, Kubota et al. describes (at paragraphs 0006 and 0061) how a "processing gas (a recycling gas) from a circulating route is designed to be combined with another processing gas from an ordinary gas supply route...." The processing gas is  $CF_4$ ,  $C_2F_6$ ,  $NF_3$ , etc.  $CF_4$  in these examples is a processing gas supplied to the reactor and Kubota et al. does not discuss  $CF_4$  generated by the plasma.

Claim 1 of the present application includes limitations directed to: (1) adding virgin  $C_2F_6$  or  $CF_4$  to the CVD chamber effluent gas in sufficient quantity to create a third PFC gas mixture having the first ratio of  $C_2F_6$  to  $CF_4$ , (2) using the third PFC gas mixture as the influent gas to the CVD chamber, and (3) continuing to add virgin  $C_2F_6$  or  $CF_4$  to the effluent gas to create the third PFC mixture and continuing to use the third PFC gas mixture as the influent gas to the CVD chamber. As stated above, these claim limitations are not taught or suggested by Kubota et al.

It is therefore respectfully requested that the Examiner withdraw the rejection of claim 1 and its dependent claims, claims 2, 8 and 9, and pass these claims to allowance.

**REJECTION UNDER 35 U.S.C. § 103:**

The Examiner next rejected claims 10-15 under 35 U.S.C. § 103 as being unpatentable over Kubota et al. The Examiner states that Kubota et al. fail to disclose that the first ratio of  $CF_4$  to  $C_2F_6$  is greater than or equal to 1. However, the Examiner states that it would have been

Application No. 10/085,249  
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obvious to manipulate the ratio of the PFC gas mixture because Kubota et al. disclose the use of a mixture of  $\text{CF}_4$  and  $\text{C}_2\text{F}_6$  in the cleaning process of the CVD chamber and that one would manipulate the ratio for the purpose of better and efficient results. The Examiner went on to state that one of ordinary skill in the art would expect that by increasing flow rate of any one gas would change the ratio of the gas.

Independent claim 10 includes substantially the same claim limitations as independent claim 1, but adds a new limitation directed to the first ratio of  $\text{C}_2\text{F}_6$  to  $\text{CF}_4$  being greater than or equal to one. For the reasons stated above with respect to the rejection under 35 U.S.C. § 102(e), it is asserted that claim 10 is allowable over the prior art. Claims 11-15 depend from claim 10. It is therefore respectfully requested that the Examiner withdraw the rejection under 35 U.S.C. § 103 and pass claim 10-15 to allowance and issuance.

Finally, in claim 9, "total gas volume" has been amended to read "total PFC gas volume" to more properly state that which the inventors believe to be their invention.

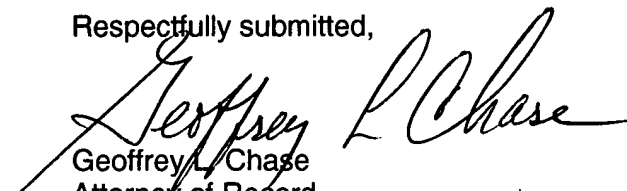
The prior art that is of record, but not specifically relied upon by the Examiner, is deemed by applicant to be less relevant than that art specifically cited.

Application No. 10/085,249  
Amendment Dated June 10, 2004  
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**NOTE**

Applicants request that the Examiner notify the undersigned attorney when Examiner takes up this case for further review and examination. Applicants desire to have a telephone interview with the Examiner if the present amendment does not place the application in condition for allowance. Therefore, if the Examiner intends to issue an Office Action rejecting any of the claims as amended, it is respectfully requested that the Examiner first call the undersigned attorney prior to issuing an Office Action so that a telephone interview can be arranged.

Respectfully submitted,

  
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